Production of Volatile Organic Compounds Using Oil Palm Frond Juice as a Sole Substrate by *Ceratocystis fimbriata*

Penghasilan Sebatian Organik Meruap Menggunakan Jus Pelepah Kelapa Sawit Sebagai Substrat Tunggal oleh *Ceratocystis fimbriata*

Nang Nor Azimah Long Nadzri,[1] Mior Ahmad Khushairi Mohd Zahari,[1*] Saiful Nizam Tajuddin,[2] Che Mohd Aizal Che Mohd [2]

[1] *Faculty of Chemical & Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia*

[2] *Bio Aromatic Research Centre of Excellence, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia*

[*]*Corresponding author: ahmadkhushairi@ump.edu.my, Tel: 09-5492837, Fax: 09-5492889*

Abstract

In this paper, the potential of oil palm frond (OPF) juice as an alternative and renewable carbon source to replace the function of glucose for the production of volatile compounds by *Ceratocystis fimbriate* will be reported. The OPF juice was extracted using simple physical separation method. The growths of fungi were monitored by using cell dry weight (CDW) method whereby the characterization of sugar composition and consumption of the OPF juice by *Ceratocystis fimbriata* were carried out using High Performance Liquid Chromatography (HPLC). The volatile organic compounds were separated and analyzed by Gas Chromatography-Mass Spectroscopy (GC-MS) with Solid Phase Micro Extraction (SPME). On the fourth day, the biomass produced by *Ceratocystis fimbriata* increased significantly and produced the highest number of products comprising of, 3 alcohols, 2 esters, 1 aldehyde, 1 fatty acid, 1 phenol and 1 ketone. Based on the GC-MS analysis, several volatile compounds such as aldehydes, alcohols, ketones, and esters could be produced from OPF juice supplemented with a mineral salt medium. This result shows the potential usage of OPF juice as substrates for the growth and production of volatile organic compounds by *Ceratocystis fimbriata*.

Keyword: Oil Palm Frond Juice, volatile organic compounds, *Ceratocystis fimbriata*.

Abstrak

Dalam laporan ini, kajian mengenai kebolehan jus pelepah kelapa sawit (OPF) sebagai sumber karbon alternatif dan yang boleh diperbaharui telah dijalankan untuk menggantikan fungsi glukosa untuk pengeluaran sebatian meruap oleh kulat *Ceratocystis fimbriata*. Jus OPF diekstrak menggunakan kaedah pemisahan fizikal yang mudah. Pertumbuhan kulat dipantau menggunakan kaedah sel berat kering (CDW) manakala pencirian komposisi gula dan penggunaannya oleh *Ceratocystis fimbriata* di dalam jus ini telah dijalankan dengan menggunakan peralatan Kromatografi Cecair Berprestasi Tinggi (HPLC). Sebatian meruap pula dipisahkan dan dianalisis menggunakan Kromatografi Gas – Spektroskopi Jisim (GC-MS) bersama Pengekstrakan Mikro Fasa Pepejal (SPME). Pada hari keempat, pengeluaran biojisim meningkat dengan ketara dan mengeluarkan produk yang paling tinggi, iaitu 3 alkohol, 2 ester, 1 aldehid, 1 acid leamk, 1 penol dan 1 keton. Berdasarkan analisis daripada GC-MS, hasil fermentasi menunjukkan beberapa sebatian organik meruap seperti aldehid, alkohol, keton dan ester boleh dihasilkan daripada jus OPF ditambah dengan media garam mineral. Hasil daripada kajian ini menunjukkan bahawa jus OPF mempunyai potensi besar untuk digunakan sebagai substrat untuk pertumbuhan dan penghasilan sebatian organik meruap oleh *Ceratosystis fimbriata*.

Kata kunci: Pelepah kelapa sawit, sebatian organik meruap, *Ceratocystis fimbriata.*

Introduction

In Malaysia, oil palm plantations and the palm oil industries were the main contributors to the generation of agricultural waste. From previous studies, researches have studied the potential of utilizing the agricultural waste efficiently. For example, the conversion of the oil palm empty fruit brunch (OPEFB) into fermentable sugar [1-3], utilization of the OPEFB as a substrate for enzyme production [4] and pulp preparation from OPEFB [5]. The common substrate used during fermentation is glucose where it functions as a source of energy or carbon source. In this research, oil palm frond (OPF) juice is used to replace the role of glucose during fermentation. OPF juice is reported to contain renewable sugars such as glucose, sucrose and fructose [6]. In addition to that, it was suggested that OPF juice have high potential to be used as a fermentation feedstock for the production of various value-added products such as polyhydroxyalkanoates (PHA), bioethanol, biobutanol, lactic acid, and succinic acid as it contains high amount of sugars [7]. OPF juice is expected to address the environmental issues for the